Mar/Apr 2016 • No. 235

ESA Newsletter

Electrostatics Society of America - The Friendly Society

President's Message

Where are they?

Our greatest resource is our membership. We have a unique mix of engineers and scientists from both industry and academics, contributing to our success as an organization. We are growing strong in terms of hosting great annual meetings with an increased number of attendees and technical sessions. We have been attracting many students to participate and present their work.

Attracting and retaining good people is one of the most challenging tasks for any organization. Why do I call attention to this topic? Because it is a growing issue for the Electrostatic Society of America (ESA). Unlike in the past, we are not attracting student members to join the society as full members. We have seen a big increase in student presentations; almost 50% of the presentations are by the students. At least some of this is attributable to the subsidizing of student presenters, consistent with a major tenet of the ESA – to promote scientific education, with a particular emphasis on electrostatics. This is really good; but where are our student members pursuing their careers? Are they still working with electrostatics? If so, why aren't they joining the society membership list? Is our full membership fee too high? Doubtful, as ESA membership fee is less than a student-membership fee in most other professional societies.

Take a look at our current membership list; members such as Mark Zaretsky and myself were student members a few decades ago (gulp!); and where are our newer generation of graduated student members? I can only think of a few in this category, such as Keith Forward. Maybe it is time for some of us to start tracing our former students (or current or former co-workers for non-academics) and bring them back into the ESA?

I would like to personally invite you to West Lafayette, Indiana for the 2016 Joint Electrostatics Conference, hosted by Electrostatic Society of America together with the Institute of Electrostatic Japan (IEJ), the IEEE Industry Applications Society (IAS) Electrostatic Processes Committee EPC), and La Societé Francaise d'Electrostatique (SFE) on Purdue University campus. Please contact Prof. Raji Sundararajan, conference general chair for any inquiries regarding the meeting.

Prof. Keith Forward, technical program committee chair for this year's joint conference, has put together a wonderful program. The technical sessions are filled with interesting talks in both oral and poster sessions, with four keynote speakers joining us from around the world. Please also note that the papers presented at the 2016 Joint Conference may be submitted to the IAS Transactions or the Journal of Electrostatics for archival publication.

Dr. Kelly Robinson has been working hard to add more flavour to the technical sessions through our popular electrostatics demonstrations. Please see inside for the details.

I would like to remind everyone about the early registration, and manuscript submission deadlines; they are May 9th (extended) and May 16th 2016, respectively. Information may also be found on the conference website *http://www.electrostatics.org/annualmeeting.html*. ESA members can also pay their membership fee together with the conference registration by clicking the 4th option of "Registration and ESA membership". The statistics on membership renewal is surprisingly bad. Dr. Steve Cooper has sent the ESA dues invoices. There are no reminders sent, or penalty for late payments. This is only a kind request to you to renew your membership for 2016.

(cont'd. p. 2)

President's Message (cont'd.)

Take advantage of the 2-in-1 option by clicking "Registration and ESA membership". Looking forward to seeing you all in June!

For the Friendly Society
Shesha Jayaram, *shesha.jayaram@uwaterloo.ca*
President, Electrostatics Society of America

ESA2016: Electrostatics Demos

At the upcoming 2016 Electrostatics Joint Conference scheduled for June 13-16, 2016 at Purdue University in West Lafayette, Indiana, we will have a special evening workshop devoted to electrostatics demonstrations. The goal is to provide a variety of demonstrations from educational experiments to safety and consulting topics, building upon the very successful demonstration workshops at our 2012 ESA/IEJ/IAS/SFE Joint Meeting in Waterloo and our 2014 ESA Annual Meeting at Notre Dame. The evening event is scheduled for Tuesday evening June 14 on the Purdue University campus.

Several demonstrations are scheduled including:

- Sethar (Duke) Davis, Wabash Instruments, will show us some of the electrostatics demonstration equipment available from Wabash Instruments.
- Steve Cooper, Sunless Inc., will demonstrate electrostatically enhanced powder coating.
- Kelly Robinson, Electrostatic Answers, will show that charge density on an insulating sheet may be measured using an electrostatic fieldmeter and that a grounded sewing needle can dissipate static charge.
- Darryl Pecquet has kindly loaned his 1954 Naval Electrostatic Kit to the ESA. We will display this historic equipment so that together, we may learn how it advanced electrostatics knowledge!

Soon, I hope to announce several additions to our program. Please plan to attend our 2016 Electrostatics Joint Conference and join us for our Special Session devoted to electrostatic demonstrations. If you have any questions or if you need additional information, please contact Kelly Robinson, who is coordinating the session.

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ESA Officers

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Calendar

- 2016 Electrostatics Joint Conference, June 13-16, 2016, Purdue University, West Lafayette, IN, USA, *http://www.electrostatics.org/conferences.html* Contact: Raji Sundararajan, *rsundara@purdue.edu*
- IEEE 34th Electrical Insulation Conf (EIC), June 19-22, 2016, Montreal, Quebec, *http://sites.ieee.org/eic/* Contact: Bernard Noirhomme, *noirhomme.bernard@ireq.ca*
- 1st Int'l Conf. on Dielectrics (ICD), July 3-7, 2016, Montpellier, France, *http://www.ies.univ-montp2.fr/icd2016/* Contact: Jérôme Castellon, *chairman@icd-2016.org*
- STEP-2, 2nd Int'l Workshop on Static-Tribo-Electricity of Powder, August 4-6, 2016, Compiègne, France, *http://www.t.soka.ac.jp/powder/STEP2/index.html*
- SFE-2016, August 29-31, 2016, Poitiers, France, *http://sfe2016.conference.univ-poitiers.fr/en/* Contact: Thierry Paillat (*thierry.paillat@univ-poitiers.fr*)or Gérard Touchard (*gerard.touchard@univ-poitiers.fr*)
- 38th Annual EOS/ESD Symposium, Sept. 11-16, 2016, Garden Grove, California *https://www.esda.org/events/eosesd-symposia/symposia/?utm_content=ed5cad18ba077c3aeb23013de9cbe3a9&utm_campaign=2016%20Symposium%20Call%20for%20Papers&utm_source=Robly.com&utm_medium=email* Contact: *info@esda.org*
- XIV Int'l. Conf. on Electrostatic Precipitation (ICESP 2016), Sept. 19-23, 2016, Wroclaw, Poland, *http://www.icesp2016.pwr.edu.pl* Contact: Arkadiusz Świerczok, *icesp2016@pwr.edu.pl*
- CEIDP, Conf. on Elec. Insul. & Diel. Phen., Oct. 16-19, 2016, Toronto, Canada, *http://sites.ieee.org/ceidp/2016-ceidp-info/* Contact: Resi Zarb, *rzarb@irispower.com*
- Electrostatics 2017, April 10-13, 2017, Frankfurt/Main, Germany, *http://www.dechema.de/en/electrostatics2017.html* Contact: Nadja Strein, *strein@dechema.de*

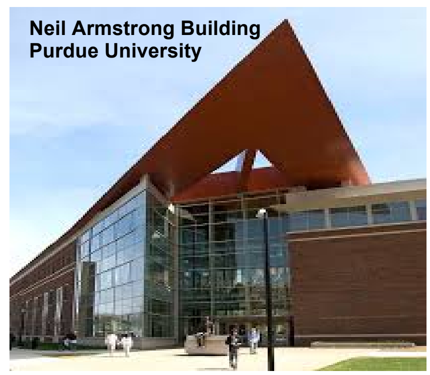
2016 Electrostatics Joint Conference

Purdue University
West Lafayette, Indiana, USA
June 13 - 16, 2016

The Electrostatic Society of America (ESA), Institute of Electrostatic Japan (IEJ), International Electrostatic Assembly (IEA), Industry Applications Society (IEEE-IAS) Electrostatic Processes Committee, and La Societé Francaise d'Electrostatique (SFE) invite papers in all scientific and technical areas involving electrostatics. The scope of the conference ranges from the fundamental physics underlying electrostatics to applications in industry, atmospheric and space sciences, medicine, energy, and other fields. The meeting will bring together experts across the diverse field to present the latest developments in electrostatics.

Anticipated Technical Session Topics

- Atmospheric and space applications
- Biological and medical applications
- Breakdown phenomena, safety and hazards
- Contact charging and triboelectric effects
- Electrically-induced flows and electrokinetics
- Flows, forces and fields
- Gas discharges and microplasmas
- Electrospinning and material processing
- Measurements and instrumentation
- Particle control and charging



Neil Armstrong Building
Purdue University

Keynote speakers:

- Dr. Heinrich Jaeger (University of Chicago, USA)
- Dr. Tomoyuki Kuroki (Osaka Prefecture University, Japan)
- Dr. Eric Moreau (University of Poitiers, France)
- Dr. George G Chase (University of Akron, USA)
- Dr. N. K. Kishore (Indian Institute of Technology Kharagpur, India)

Conference information, including, registration and lodging is available at
http://www.electrostatics.org/annualmeeting.html

Important dates:

May 9, 2016	Early registration deadline (Extended)
May 16, 2016	Final conference proceedings deadline
June 13, 2016	Reception (6-9PM)
June 14, 2016	Conference begins (8AM)
June 16, 2016	Conference ends after evening banquet (Banquet: 7 PM – 10 PM)

Contact information:

For questions regarding the technical program and abstract submission, contact
Technical Chair: Dr. Keith Forward, California State Polytechnic University, Pomona, kmforward@cpp.edu
For all other questions, contact
General Chair: Dr. Raji Sundararajan, Purdue University, raji@purdue.edu

Current Events

In electrifying advance, researchers create circuit within living plants

Robert F. Service

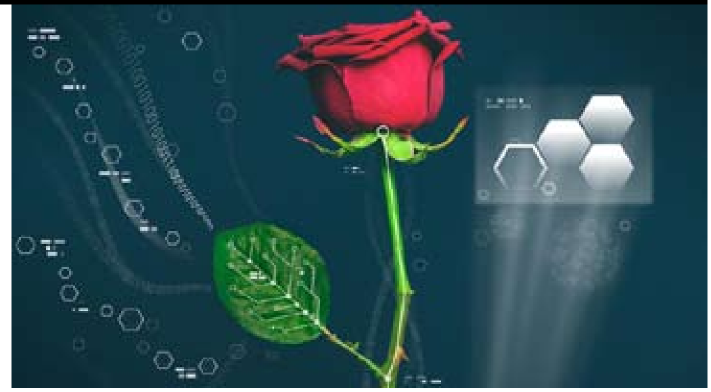
Talk about flower power. Researchers have crafted flexible electronic circuits inside a rose. Eventually such circuitry may help farmers eavesdrop on their crops and even control when they ripen. The advance may even allow people to harness energy from trees and shrubs not by cutting them down and using them for fuel, but by plugging directly into their photosynthesis machinery.

Flexible electronics are made from pliable organic materials. That makes them potentially compatible with tissues and has spurred research efforts to use them to diagnose and treat diseases. "Organic electronics is booming in the area of medical applications," says Magnus Berggren, a materials scientist and electrical engineer at Linköping University, Norrköping, in Sweden and a leader in devising such medical applications.

About 15 years ago one of Berggren's plant biology colleagues asked whether it would be possible to place electronics inside trees in order to eavesdrop on the biochemical processes going on there. If so, perhaps they could control, for example, precisely when a tree flowers. "We thought it was a joke," Berggren says. After all, he notes, biologists have made steady strides in genetic engineering techniques to control myriad biochemical functions in plants. However, genetically engineered plants have a much harder time being approved for release in Sweden than they do in the United States. "We felt those technologies were never going to make it into the forests and fields here," Berggren says. So a couple of years ago he and his colleagues decided to give electronic plants a second look.

Their idea was to use the plants' own architecture and biology to help them assemble devices on the inside. To do so, they aimed to assemble polymer-based "wires" on the inside of a plant's xylem, the tubelike channel that transports water up a plant's stem to the leaves. They thought that if they could dissolve conducting polymer building blocks in water, perhaps plants could pull them up the channels and link them together into wires.

Berggren and his colleagues tried more than a dozen different polymer electronic building blocks. They dissolved them in water, then placed roses—either with intact roots or cut at the stem—in the water to see whether the organics would be wicked upward. All of



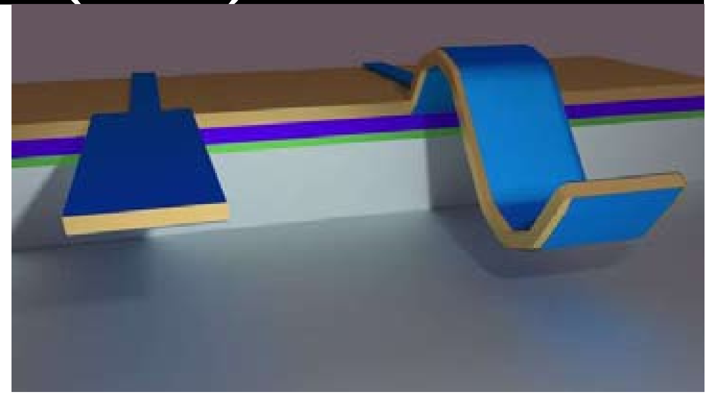
the building blocks either clogged the base of the stem or didn't assemble into wires.

Finally they tried an organic electronic building block called PEDOT-S:H. Each of these building blocks consists of a short, repeating chain of a conductive organic molecule with short arms coming off each link of the chain. Each of the arms sports a sulfur-containing group linked to a hydrogen atom. Berggren's group found that when they placed them in the water, the rose stems readily pulled the short polymer chains up the xylem channels. The intact plants pulled the organics up through the roots as well, though much more slowly, Berggren says. Once inside, the chemistry in those channels pulled the hydrogen atoms off the short arms, a change that prompted the sulfur groups on neighboring chains to bind together. The upshot was that the myriad short polymer chains quickly linked themselves together into continuous strings as long as 10 centimeters. The researchers then added electronic probes to opposite ends of these strings, and found that they were, in fact, wires, conducting electricity all down the line.

Once that worked, Berggren's team added other electronic patches on the surface of their rose stems to create transistors that were able to switch the current in a wire on and off. As they report today in Science Advances, they went on to use a set of different techniques to show they could get leaves to take up organic electronics, essentially creating an array of pixels. By applying different voltages to the pixels, they could change their colors to create a living display.

(excerpted from *http://www.sciencemag.org/news/2015/11/electrifying-advance-researchers-create-circuit-within-living-plants*)

Researchers develop flexo-electric nano-material



Researchers at the University of Twente's MESA+ research institute, together with researchers from several other knowledge institutions, have developed a 'flexo-electric' nanomaterial. The material has built-in mechanical tension that changes shape when you apply electrical voltage, or that generates electricity if you change its shape.

In an article published in the leading scientific journal Nature Nanotechnology, the researchers also show that the thinner you make the material, the stronger this flexo-electric effect becomes. Professor Guus Rijnders, who was involved in the research, describes this as a completely new field of knowledge with some interesting applications. You could use the material to recharge a pacemaker inside the human body, for example, or to make highly sensitive sensors.

Piezoelectric materials are widely used in electronic applications. In specific terms, these are crystalline materials that can convert electrical power into pressure and vice versa. The disadvantage of these materials is that they contain lead - which has environmental and health risks - and that the piezoelectric effect decreases when you make the material thinner.

Ever since the 1960s physicists have been arguing that the flexo-electric effect could exist. This would enable non-piezoelectric materials to be given piezoelectric properties. At that time, however, manufacturing methods were inadequate for the production of such materials. Now, researchers from the University of Twente, the Catalan Institute of Nanoscience and Nanotechnology and Cornell University have succeeded in developing a flexo-electric nano system just 70 nanometres thick. It turns out that even though the flexo-electric effect is very weak, the thinner you make the material, the stronger the effect becomes.

According to Professor Guus Rijnders, who was involved in the research, it will eventually be possible to create flexo-electric materials with a thickness of just a few atomic layers. This discovery could have all kinds of interesting applications. 'You could make sensors that can detect a single molecule, for example. A molecule would land on a vibrating sensor, making it just fractionally heavier, slowing the vibration just slightly. The reduction in frequency could then easily be measured using the flexo-electric effect.' In addition to ultra-sensitive sensors, flexo-electric materials could also be useful in applications that require a limited amount of power, but which are difficult to reach, such as in pacemakers or cochlear implants inside the human body.

(excerpted from *http://phys.org/news/2015-11-flexo-electric-nanomaterial.html?*)

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